# Social Meaning-Making: Making Sense of Inscriptional Construction Practices

David M. Bowers, Amit Sharma, Taren Going, Merve N. Kursav, Yvonne Slanger-Grant
Elizabeth Phillips, Alden J. Edson, Kristen Bieda, and Joseph Krajcik
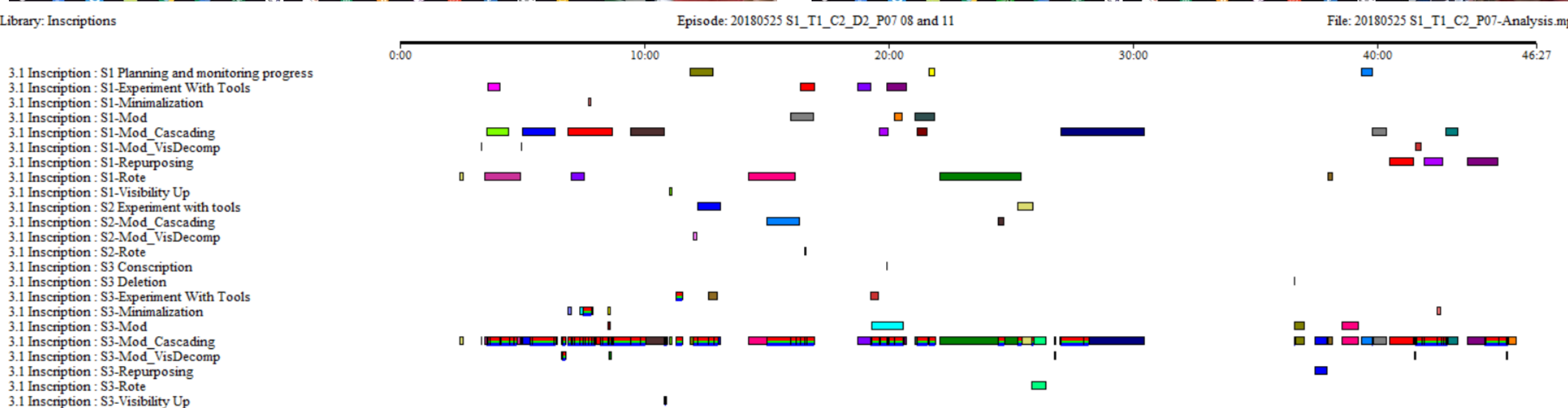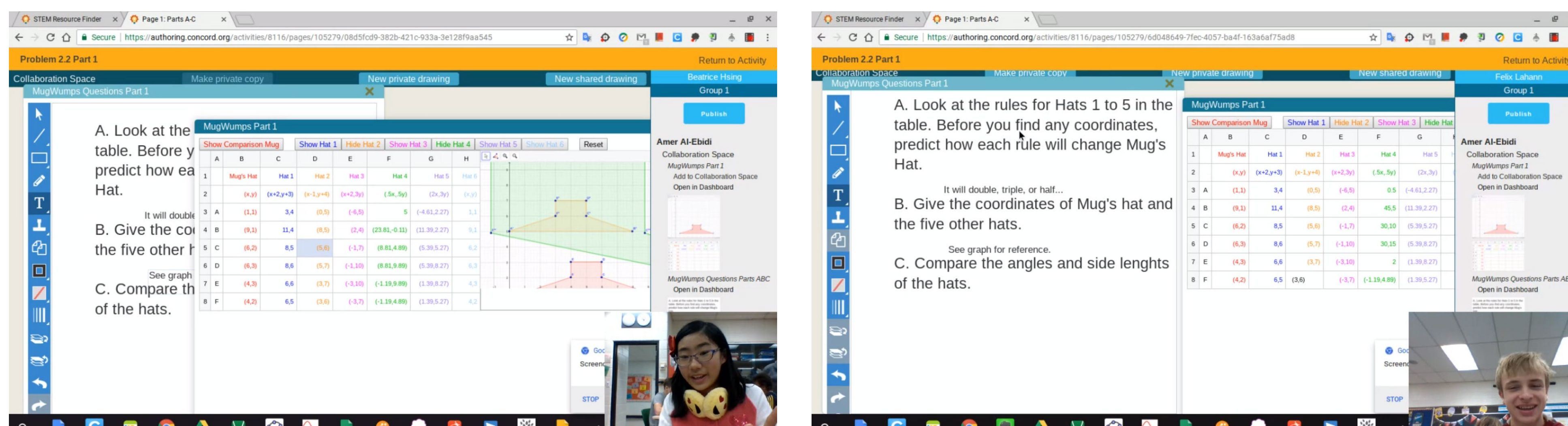Michigan State University

Context of the Study

- Roth and McGinn (1998) advance a theory of inscriptions as social practice based on the work of Latour. The term *inscription* refers to external representations of thinking that exist in material form and "take their characteristic shape and meaning from the contexts, purposes, and functions of their use (Roth & McGinn, 1998, pp. 37-38).

- Some existing work recognizes and/or operationalizes various inscriptional construction practices. However, these practices are scattered ad-hoc across the literature.

- As a part a four-year design research study that explores student learning and engagement with digital technologies, we advance an analytic framework to capture middle grades students' inscriptional construction practices in collaborative settings. Our work is guided by the following questions: (1) What inscriptional construction practices have been noted in the extant literature, (2) are we observing any practices that have not been previously noted in the literature, and (3) how can we synthesize these practices into an actionable coding scheme for capturing inscriptional practices in a middle grades mathematics classroom.
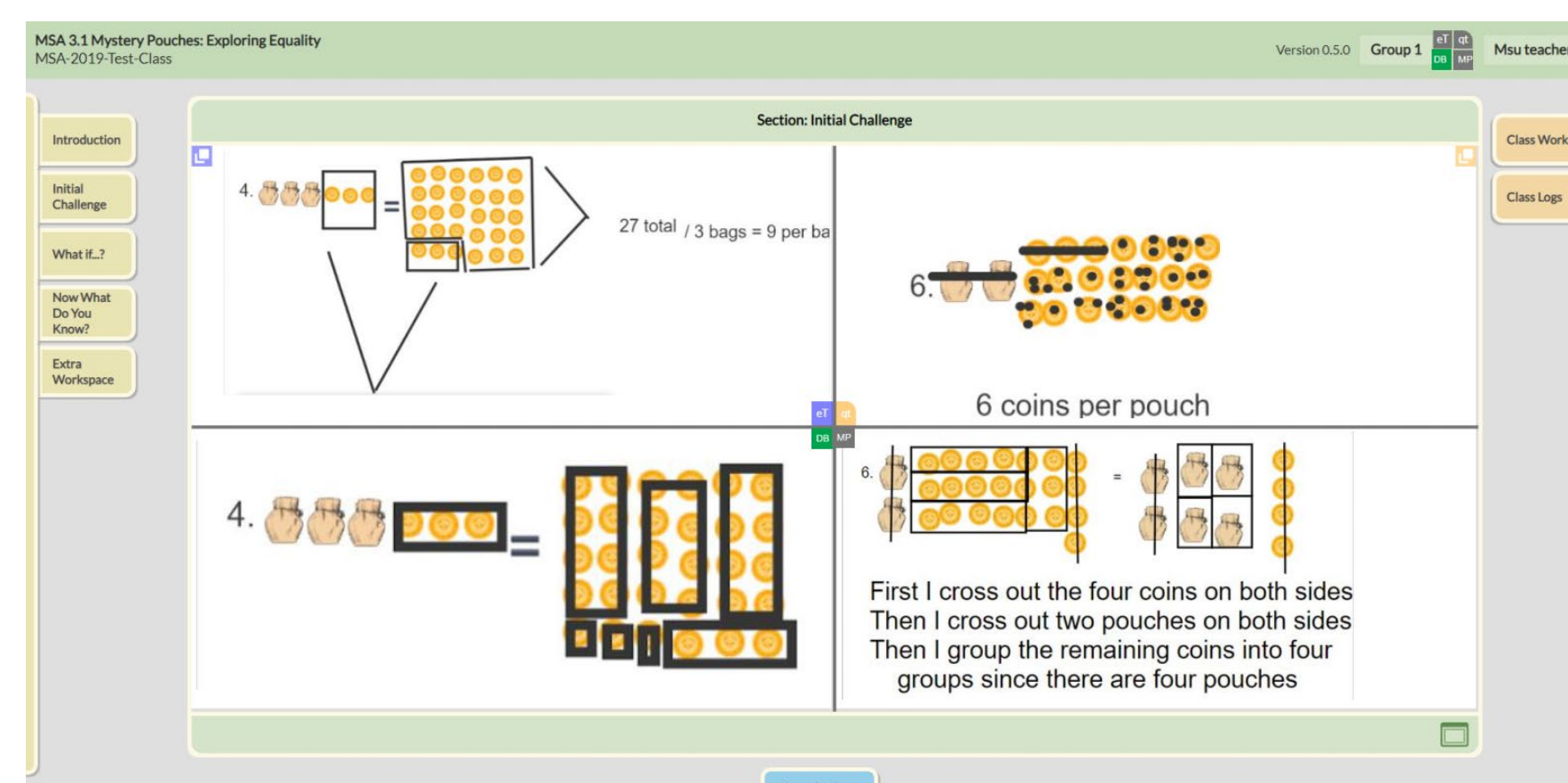
Research Methods

- The framework was developed using a two-phase iterative process:

  - The first phase involved identifying, compiling, and incorporating inscriptional practices that existed when reviewing empirical studies in the educational literature. From a pool of 23 research studies, eight studies provided empirically based inscriptional practices.

  - The second phase involved engaging in iterative cycles of axial coding. The development process included iterative cycles of restructuring and refining our framework through coding of the videos until we were no longer able to identify inscriptional practices that fell outside of our framework. Throughout this process, the researchers engaged in cycles of independent coding of the videos using the Transana software. Each cycle was followed by discussions on the coding results and any disagreements in the coding. The discussions led to consensus in the codes to ensure interrater agreement on the application of codes to data.

Framework for Inscriptional Construction Practices

Code	Definition
A. Rote	Students construct if they engage in mechanical and repetitive construction behavior. This includes copying work from one place to another without modifying the inscription, or recording the results of computation or measurement.
B. Experimentation with Tools	Students construct if they engage in behaviors that intend to help a participant become familiar with the affordances and constraints of a set of construction tools. For example, students may use the tools in isolation to "get a feel" or become familiar with them. Students might engage with more active meaning-making processes with others.
C. Planning and Monitoring Progress	Students engage in behaviors to plan what to do next and/or monitor what has been done so far. For example, students may discuss their outline for how to approach the problem.
D. Deletion	Students engage in behaviors where a solution path, inscription, or component thereof is abandoned, resulting in the object being deleted.
E. Visibility	Students engage in behaviors that change who can view an existing inscription or inscriptional component
--Ei. Visibility Up	A specific type of visibility where more people can view the inscription. This may result in an increase in author vulnerability.
--Eii. Visibility Down	A specific type of visibility where less people can view the inscription. This may result in a decrease in author vulnerability.
F. Minimalization	Students substitute labels or other secondary features of inscriptions that might otherwise appear in an inscription with language or gestures. Substitution of gestures or language might occur within the digital space (e.g., cursor movement/chat feature).
G. Modulate Perspective	Students engage in behaviors that physically change an inscription to allow oneself and others to observe it from an additional layer or a new perspective.
--Gi. Visualize Decomposition	A specific type of modulate perspective wherein an inscription is visually decomposed into more componenets, such as through movement, barriers, use of color, etc.
--Gii. Visualize Composition	A specific type of modulate perspective wherein separate components or inscriptions are combined, such as through movement, connecting lines, etc.
--Giii. Cascading Inscriptions	A specific type of modulate perspective wherein an inscription is changed into a more (or less) abstract representation. For example, a table may be changed into graph. This is often characterized as movement from experience near to experience distant (or vice versa).
--Giv. Viewing Perspective	A specific type of modulate perspective where physical changes occur to the inscription that shift the perspective. However, no component of the inscription is modified. (e.g., reorientation, zooming).
H. Inscriptions as Conscriptional Devices	Students use an inscription to enlist participation of a group, shape the structure of a groups work, and self-reflectively relate the process of their construction to the final product.
I. Repurposing of Prior Inscriptions	Students modify their perspective on how to make sense of the inscription without modifying the physical inscription itself. For example, students may consider different features of the inscription or modify the context of the inscription.

Open Questions and Early Observations

- In the classroom episodes we have analyzed, the most common practices are the various types of modulate perspective, especially cascading. The classrooms we observed make heavy use of active learning, and we might posit that in a "traditional" class most of the observed practices would be rote.

- Deletion is a rare code in our analyses so far. Students seem more prone to modifying work they perceive as inadequate than they are to discarding it wholesale and beginning anew. .

- Minimalization, the replacement of features that could appear in an inscription with gesture, traditionally connotes physical gesture. We found it interesting to note that digitized versions of minimalization were not uncommon.

Reference

Roth, W-M. & McGinn, M. K. (1998). Inscriptions: Toward a theory of representing as social practice. *Review of Educational Research, 68*(1), 35-59.